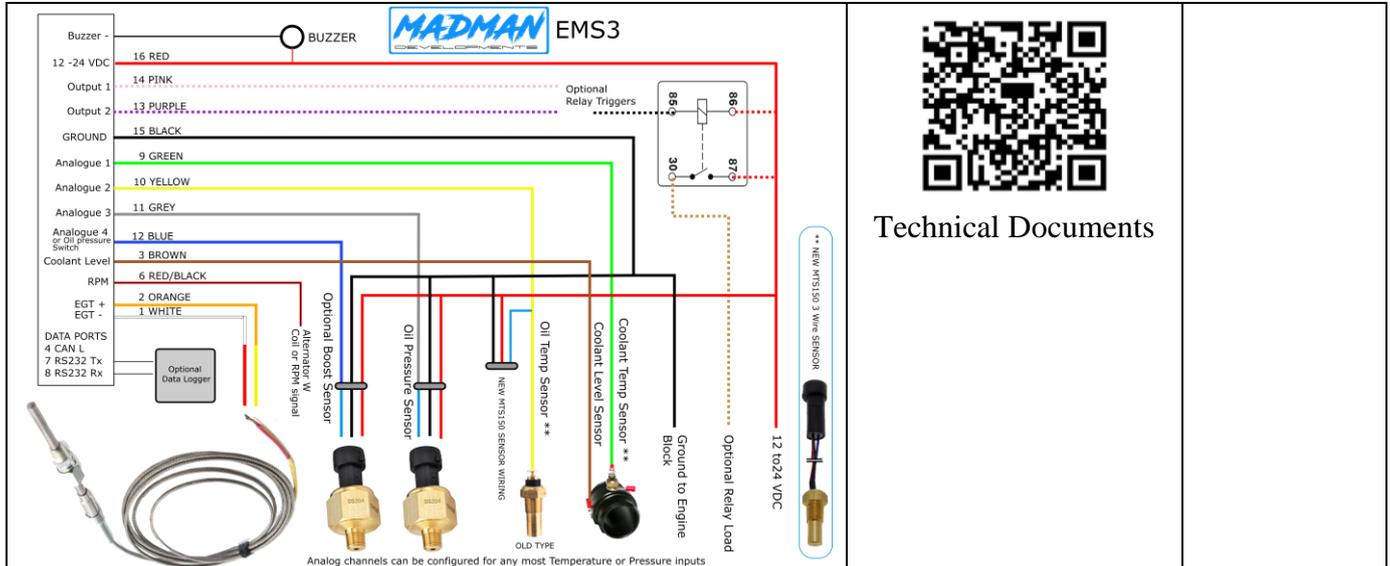


EMS Installation Instructions

The EMS1 and EMS2 are functionally identical and, as such, their installation is identical.

Both EMS versions use the same connector as follows:



Technical Documents

FITTING

You can use any number or combination of senders with your EMS – those functions that you do not use can be disabled within the menu structure.

Wire sizes used can be the same as the wires used on the harness supplied. Ensure that all connections are mechanically and electrically secure. Soldered connections can lead to breakages were the solder stops due to the rigidity of the soldered joint. Screw terminals, crimp terminals or twisted wire joints should rather be used.

The supplied harness should be sufficiently long. Should it be necessary to extend the wires you can order the EMS extension harness which adds 1.5 meters at a time to the total length. If it is only a few wires that need extension, use the same thickness and colour to ease later fault finding.

Run wires next to other wiring where possible and avoid bridging open un-occupied gaps such as from the body to the engine. It is preferable to place the wiring into split sleeving, spiral binding or wind it in cloth type insulation tape to keep the wiring safe and add a bit of mechanical protection.

Tie the wiring up against other wiring or secure points along the way using cable ties.

EARTH and POWER

When doing the wiring of the unit, it is critical that you fit the black earth wire to the engine block – failure to do so this will result in erratic readings as other loads are switched on such as lights, fans, indicators etc. Avoid using multiple earths, where an additional earth is required such as in the coolant temperature or water level wiring, run the earth to the SAME POINT as the EMS black wire earth point.

Obtain your power for the unit from behind the instrument cluster, fuse box or elsewhere behind the dash. The power source should be on the same circuit as the ignition wiring which makes the battery and oil pressure lights come on when turning the key.

The EMS unit has built in spike and over-voltage protection however, it is only effective if a 0.5 Amp fuse is fitted in the red positive wire.

FITTING SENDER UNITS (Apply loctite to all fittings, NOT PTFE tape)

COOLANT / WATER LEVEL

The coolant level sensor built into the EMS1 and EMS2 unit is able to measure coolant level electronically and is able to prevent corrosion / scaling on the level probe.

The BROWN wire is the sensing wire and it works relative to earth.(BLACK)

There are 3 ways to measure coolant level:

SENSING SCREWS

The most effective way of coolant detection is to screw two self tapping screws into the expansion bottle, horizontally, approximately 25mm below the low the normal level (or at the LOW level) and approximately 25mm apart.

Some kits use two 4.2mm stainless steel screws, these can be screwed into a 1.5 to 2mm hole drilled into a plastic coolant tank without any leakage. This method has proven to be very effective.

The coolant bottle must be the type that has a pipe leading out the BOTTOM of the bottle to the coolant system lower hoses, as well as a smaller bleed hose near the top. IF the bottle only has one pipe near the top, it WILL NOT empty when the coolant is drained from the engine and will therefore NOT report low coolant faults.

HOSE ADAPTER (AHxx)

If the coolant system does not have a plastic expansion bottle, you could use a Hose Adapter (AHxx) as detailed later in this document under COOLANT TEMPERATURE.

LEVEL SWITCH

This is a mechanical sensor which is mounted into the coolant bottle or radiator top tank (space permitting) and is used as a last resort for coolant level as it is sensitive to metal particles in the coolant. Installation instructions are included with the switch.

EGT (Exhaust Gas Temperature)

The EGT is read directly from the exhaust manifold or down pipe via a drilled and tapped hole or EGT plate where available. Some vehicles have EGR ports which could be used for the EGT probe.

Installation of the probe is achieved in one of two ways:

- Fitted to an EGT plate where available for your car model
- Drill and tap the manifold.

If a plate is used, it can be sealed with exhaust paste (Fire gum) or putty (Gun Gum) – Do not use silicone sealer as it will burn away and leak.

Drilling the Hole in the Manifold:

Where possible, the manifold must be drilled on the bench, If it is not practical to remove the manifold for drilling, the following procedure can be followed with good results:

1. Locate a suitable location in the exhaust manifold for the probe that offers easy access for a drill, preferably close to the Y point where all cylinder ports come together before the turbo. In some cases this is just not possible and the probe must be fitted after the turbo/s, in this case the closer the better to the turbo and you will have to subtract about 100 deg C from EGT readings to roughly equate to the real EGT reading before the turbo.
2. With the engine IDLING, drill a 5mm hole into the manifold - be careful to protect your eyes as the exhaust gas will blow the swarf back at the drill and the exhaust gas will be hot.
3. Re-drill the 5mm hole to a 9mm hole using light pressure to ensure small swarf particles.
4. Using a 1/8 NPT-27 thread tap, tap the hole in the manifold until the last two threads of the tap are still outside the hole.
5. Switch the engine off and fit the probe compression body as detailed below.

Mounting the Probe in the Hole:

Fit the body of the compression fitting into the hole first and tighten - no sealant is necessary - use a socket or ring spanner to prevent damage to the fitting.

Fit the compression nut, then cutting ring to the probe, then slide the probe into the fitting body and tighten the compression nut by hand – it may not bite on the probe yet.

The depth of the probe must be adjusted so that the tip of the probe is in the centre of the gas flow in the manifold. If either the tip touches the inside of the manifold or the probe is fully upto its shoulder, the probe must be pulled back by at least 10mm.

Tighten the compression nut while holding the body securely (with an open spanner)

The compression nut can be tightened firmly such that the probe becomes clamped in the fitting. After this is done, the cutting ring is then permanently fixed to the probe shaft.

To remove the probe (for during engine repair), simply loosen the compression nut and pull the probe, nut and captive cutting ring out of the body leaving the body in the manifold. Mention this to any mechanic working on the vehicle as damage to the probe due to incorrect removal will result in you having to buy a new probe.

Note that the braided stainless steel lead cannot be twisted and must be unwound. To tie up extra length in the probe lead, fold it in a figure 8 and secure with a cable tie. Remember that the outer steel braiding is earthed, do not let it short against live points behind the dashboard.

EGT probe wires can also be lengthened if needed using plain copper wire, preferably of the same colour. Make the wire connection between the EGT probe and the EMS harness inside the vehicle cabin and not in the engine bay. This ensures better accuracy in the readings.

Always make the crimp connection on the end of the EGT probe lead on the inside of the cab away from the heat of the under bonnet environment. The probe measures temperature difference between the tip (in the manifold) and the end of the wire, so it is best to keep the end of the wire at normal ambient temperature rather than the highly elevated temperature of the engine compartment.

Fitting Tips

In some cases the probe is simply too long to fit in the area or it must go around a corner to reach the exhaust gas flow. In these cases it is perfectly safe to gently bend the probe (once fitted through the compression fitting) and insert the bent probe in the manifold such that it does not touch any internal part of it.



COOLANT TEMPERATURE

There are 3 types of Coolant Temperature Adapters.

The hose adapters offer a coolant temperature AND a coolant level measuring facility, hence their popularity, alternately the Sandwich Adapter or Adapter Plug can be used.



The hose adapters are available in the following sizes :

32mm, 35mm, 38mm, 42mm and 50mm which is measured to suit the INTERNAL diameter of your coolant hose, the part number indicates the size :- AH32 = 32mm hose ID

Ensure that your coolant hose is a comfortable fit on the adapter body, the ridge at the end will be tight and is designed to keep the pipe/clamp from slipping off.

The temperature port on the adapter has a 1/8 NPP – 27 thread (Parallel Thread) suitable for a VDO temperature sender. The other port on the adapter is a M5x0.8 thread suitable for a standard galvanised M5 screw which is used as a coolant level sensing probe.

AHxx Kit Contents:

1. Machined Plastic hose adapter
2. 2 x Hose Clamps
3. M5 Machine screw
4. M5 Round lug
5. M10 Round Lug
6. 6.3mm Spade lug

NOTE: The Temperature sender is NOT included in the kit.

The M5 screw is the Coolant Level Sensor. The screw is screwed into the hole provided in the adapter and the brown EMS wire is connected to the screw using the M5 round lug provided to provide coolant level detection, if unused, simply exclude the brown wire.

The M10 round lug is the earth for the temperature sender and must be fitted under the temperature sender and connected to the EMS earth (black) wire at the same point where the EMS is earthed to the engine head or block.

The 6.3mm flat spade lug fits on the top fitting of the temperature sender and connects to the EMS coolant temperature wire (Green)

Fitting Tips

- All AHxx adapters are made from engineering plastic, they therefore do not conduct electricity and an earth is required when fitting a temperature sender to the adapter.

- The lug must be fitted under the temperature sender head and clamped down to keep the earth lug firm. Should the temperature sender tighten firmly and the lug is still loose, fit a 10mm washer under the temperature sender to take up excessive space.
- It is best to cut a portion of the original coolant hose out - equivalent to the center portion of the adapter when fitting it to prevent the hose from touching other engine components due to increased length.
- When fitting screws and senders to the adapter, use a bit of liquid thread locker (loctite) to keep the fitting tight and to provide a good leak proof seal.

TEMPERATURE SENDERS



Temperature Senders

The VDO 150 deg C Sender is used for both coolant and oil temperature measurement. It is either screwed directly into the housing, or sometimes an adapter is needed to adjust a larger thread to suit the sender thread.

On some vehicles, there is no space to fit a temperature sensor to the engine, in these cases a hose adapter can be used (AHxx) as above.

Temperature Range: 50-150 Deg C (122-302 Deg F)

Type: VDO 323 801 009 001

Electrical Fitting: Flat 6.3mm Uninsulated Spade (Female)

Thread: 1/8 NPT-27

Fitting Tips

This sender requires an earth path to operate. If the sender is screwed into a plastic housing such as the MadMan AHxx adapter, the sender body **MUST** be earthed back to the EMS earth and engine block with the supplied 10mm lug. The lug must be fitted under the head of the sender before screwing it in. When fitting this sender, apply a bit of liquid thread sealant / lock such as loctite before screwing it in. This helps to keep the sender secure and ensures a leak proof seal.

Do not use thread tape as it will affect the electrical conduction from the sender to the housing in metal installation locations.

OIL / FUEL / BOOST PRESSURE

The MPSxx Sensor is used for all pressure sensing. The sensor is available in a range of pressures, we generally use:

MPS2 = 2 Bar = 30 Psi

MPS5 = 5 Bar = 75 Psi

MPS7 = 7 Bar = 100 Psi

MPS10 = 10 Bar = 150 Psi

In Boost applications, the sender is either screwed directly into the housing (1/8 NPT Thread) or into a Tee on the boost pipe or into a remote mounted fitting away from the engine.



For Oil pressure applications the sender is screwed directly into the engine block, usually via an adapter of some sort. Where space is limited or engine temperature will cause damage to the sender, an oil extension hose is supplied to fit the sender away from the engine.

Pressure senders can only tolerate 100 deg C for reasonably short periods, so fitting an extension hose is a good investment in hot installations.

Fitting Tips:

These senders do not require an earth path to operate. The earth is supplied via the wiring harness. It is important to note that the sensor body is brass and the spanner used is large, take care not to snap the tip of the sender off. Use a little loctite on the threads to ensure a good tight seal.

If an extension hose is supplied, you will also be provided with a P clamp, this clamp is used to clamp the sender to the engine or body in a suitable location. The P clamp is supplied straight and must be bent around the sender in a 'P' shape.

LEGACY PRESSURE SENSOR - DISCONTINUED



Pressure Sender Units - DISCONTINUED

The VDO Sender was used for all pressure measurements - Oil, boost or fuel pressure.

As you have two ranges 0-5 and 0-10 bar to choose from, it is best to choose a sender based on your maximum possible pressure reading. In some cases a 0-2 Bar sender was supplied for boost, this sender is no longer available from VDO, you will have to use the 0-5 bar sender and possibly recalibrate it for maximum accuracy in a boost application.

Pressure Options:

	Part Number	
Pressure Range	Without Switch	With Switch
0 - 5 Bar (0-72 PSI)	360 081 029 004	360 081 030 049
0-10 Bar (0-145 PSI)	360 081 029 012	360 081 030 052

Electrical Fitting: 3mm Stud with Thumb nut requiring a Round 3mm Insulated Ring Terminal
Thread: 1/8 NPT-27

The senders supplied with the EMS kits have one or two terminals:

G: Gauge Terminal: Fitted on senders with one or two terminals. This terminal provides the analogue signal to the EMS oil pressure display and is connected to the **GREY** wire

WK: Warning Terminal: Only fitted to senders with two terminals. This terminal provides an on/off switch for the oil pressure light and is connected to the **BLUE** wire. Most engines had an oil pressure warning switch, it is this switch which is re-positioned to a Tee piece when fitting an oil pressure sender. The **BLUE** wire from the harness must be Tee'd into the wire from the oil pressure switch as the blue wire (EMS oil pressure warning) is a duplication of the Oil pressure warning light on the vehicles instrument panel.

In Boost applications, the sender is either screwed directly into the housing, or sometimes an adapter is needed to adjust a larger thread to suit the sender thread or a hose tail fitting can be supplied.

In cases where space is limited or engine temperature will cause damage to the sender, an oil extension hose is supplied to fit the sender away from the engine.

Pressure senders can only tolerate 100 deg C for reasonably short periods, so fitting an extension hose is a good investment in hot installations.

Fitting Tips:

These senders require an earth path to operate. Usually the sender is fitted in a metal housing which provides the earth path therefore the threads should be clean and only loctite should be used on

threaded joints to maintain the electrical conductivity.

Do not use thread tape as it will affect the electrical conduction from the sender to the housing.

If an extension hose is supplied, you will also be provided with a P clamp, this clamp is used to clamp the sender to the **engine** in a suitable location. Ensure that there is a good metal to metal contact path from the sender housing to the engine block. In these cases where a s/steel hose is used to extend the sender away from the engine, the sender must be mounted elsewhere on the engine,

If the sender is mounted to the chassis or body of the vehicle it must be electrically insulated from the mounting location to prevent earth loops which will cause erratic readings. Placing a layer of thick plastic under the clamp supplied with the adapter will be sufficient.

OUTPUTS

The EMS3 has 2 output channels, these can be set to trigger on any of the input channels. Be sure to wire the output correctly to prevent damage to the EMS3 output transistors.

A regular 35A Automotive relay must be used to drive anything more than a small buzzer or LED.

The outputs are 'Current Sinking' which means they provide an earth path to ground to switch the relay.

With reference to the wiring diagram, connect one end of the relay coil to a fused positive line and the other terminal of the relay coil to the EMS Pink or Purple wire. When the output triggers, the EMS will ground the Pink or Purple wire, thus switching the relay on.

DATA LOGGER

The installation of the data logger is detailed with the data logger unit.

*** END ***

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